

## **Machine for Removing Articles Deposited on the Ground**

This invention relates to a machine for gathering articles deposited on the ground and more particularly to a machine suitable for removing debris strown on sandy tracts of ground such as beaches. The invention further contemplates a machine suitable for use in removing debris from tracts of sandy ground in which the debris is effectively removed from the sand and collected and any sand removed in such process is returned to the ground.

### **Background of the Invention**

In the prior art, a number of machines have been developed for removing debris from the ground and particularly machines for removing debris strown on sandy beaches. Typically, such machines have been towed by a tractor, and have included an endless conveyor extending upwardly and rearwardly, means for directing debris and some accompanying sandy earth onto an upper, forwardly disposed flight of the conveyor, and a receptacle for receiving debris carried by the conveyor and discharged at an upper, rearward end thereof. Although such machines have been effective in removing and collecting such debris, they have been found not to be entirely effective in separating the debris from the sand, returning the sand to the ground and totally capturing the debris in a receptacle for removal to a suitable dump site. Accordingly, it is the principal object of the present invention to provide a machine of the type described which is operable to effectively and efficiently gather debris from the ground, separate such debris from any earth gathered by the removal mechanism of the machine, return the earth particles to the ground and capture the debris in a receptacle for delivery to a suitable dump site.

## **Summary of the Invention**

The principal object of the present invention is achieved by providing a machine generally consisting of a wheel unit; a support frame mounted on the support wheel, having means for advancing the machine along the ground; an endless conveyor mounted on the support frame, having a plurality of tines projecting from an outer side thereof, and a flight extending from a front end thereof adjacent ground level, upwardly and rearwardly to an elevated rear end; a receptacle mounted on the support frame, positioned to receive debris engaged by such conveyor tines and carried upwardly and rearwardly on such conveyor and discharged into the receptacle, and having a set of tines cooperable with the conveyor tines to disengage debris engaged by the conveyor tines; and means mounted on the support frame for driving the conveyor.

## **Brief Description of the Drawings**

Figure 1 is a side elevational view of a machine embodying the present invention;

Figure 2 is an enlarged, perspective view of that portion of the conveyor of the machine designated by the reference numeral 2 in Figure 1;

Figure 3 is a partial side elevational view of the machine shown in Figure 1, illustrating the bucket portion thereof being lifted;

Figure 4 is a view similar to the view shown in Figure 3 illustrating the bucket in an elevated position and being tilted for dumping the contents thereof; and

Figure 5 is an enlarged, partial perspective view of that portion of the machine designated by the reference numeral 5 in Figure 1, illustrating the manner of cooperation of the conveyor and bucket tines in disengaging articles carried by the conveyor tines.

### **Detail Description of the Preferred Embodiment**

Referring to the drawings, there is illustrated a machine 10 for removing debris from a tract of sandy ground such as a beach, generally including a wheel unit 11, a support frame 12 mounted on the wheel unit, a conveyor belt assembly 13 mounted on the support frame, a bucket assembly 14 mounted on the rear end of the support frame and cooperable with the conveyor assembly, and bucket tilt assembly 15 mounted on the support frame and cooperable with the bucket assembly. Wheel unit 11 is of a conventional construction including an axle and a pair of wheels. Support frame assembly 12 is supported on the axle of the wheel unit and includes a pair of longitudinal disposed, transversely spaced beams 16, 16 and a set of interconnecting cross beams (not shown). A drawbar 17 is pivotally connected to the front end thereof, which may be detachably connected to a tractor or other prime mover means for towing the machine. The angular relationship of the drawbar to the support frame assembly may be adjusted by means of a mechanism 18 which is adapted to angularly displace the drawbar relative to the support frame about an axis of a pair of curved slots 19, 19 formed in a pair of lower, transversely spaced side walls 20, 20. Mounted on beam members 16, 16 adjacent the rear ends thereof and extending upwardly and rearwardly is a pair of support beams 21, 21 interconnected by cross beams (not shown) and having a transversely disposed shaft 22 journaled in the upper ends thereof and a pair of transversely disposed shafts 23 and 24 journaled intermediate shaft 22 and the lower ends of beam members 21, 21. Also supported at the upper ends of beam members 21, 21 and at the lower ends thereof is a pair of rearwardly and upwardly extending, transversely spaced side walls 25, 25. In addition, a pair of longitudinally spaced, transversely disposed shafts 26 and 27 are journaled in beam members 16, 16.

Conveyor belt assembly 13 is best illustrated in Figures 1 and 2. It consists of an endless, conventional stainless steel conveyor belt 32 trained about drive sprockets 28, 28, idler sprockets 29, 29, idler wheels 30, 30 and idler sprockets 26, 26 to provide a lower, substantially horizontal flight 32a, an upwardly and rearwardly extending flight 32b between side walls 25, 25 and a lower, downwardly and forwardly extending flight 32c. The belt is driven by a hydraulic motor mounted on the support frame and drivingly connected to a sprocket 28 by means of a chain drive disposed within a housing 33. Conveyor belt 32 is of a chain link construction providing a plurality of openings therethrough. Mounted on the outer side of such belt is a plurality of longitudinally spaced, transversely disposed tine assemblies 34. As best shown in Figure 2, each of such assemblies includes a base strip 35 and a retainer strip 36 secured to the belt and a plurality of tine units secured between strips 35 and 36, spaced along such strips and having portions projecting substantially perpendicular from belt 32 along belt flights 32a, 32b and 32c. Each of such tine units consists of a metal wire bent at the center thereof to form a U-shaped center portion 37, having the leg segments of such U-shaped portion contouring into spiraled, spring portions 38 and 39 and having the spiral spring portions continuing as free ends 40 and 41 disposed substantially tangentially to the spiraled spring portions 38 and 39. Each of base strips 35 is disposed on the inner side of conveyor belt 32, each of retainer strips 36 is mounted on the outer side of the conveyor belt in alignment with a base strip, each of the U-shaped portions of the tine units is interposed between the conveyor belt and a retainer strip 36 and the tine units are fixed in position as shown in Figure 2 by a set of bolts 42 extending through openings in each retainer strip and openings in the conveyor belts and threaded into a base strip.

Bucket assembly 14 generally consists of a pair of transversely spaced lift arms 50, 50, a bucket 51 pivotally connected to the lower ends of the lift arms and a pair of hydraulic cylinder assemblies 52, 52 each operatively interconnecting a beam member 21 and a lift arm 50. Lift arms 50, 50 are pivotally connected at their upper ends to shaft 52. Bucket 51 is provided with a pair of trunnions 53, 53 mounted on the side walls thereof to which the lower ends of lift arms 50, 50 are pivotally connected. Each of cylinder assemblies 52 includes a cylinder member 52a pivotally connected at a base end thereof to a bracket 54 mounted on a rearward side of a beam member 21, and a rod member 52b pivotally connected to a bracket 55 mounted on the front side of a lift arm 50. It will be appreciated that by supplying fluid under pressure to the base or rod ends of cylinder assembly 52, the bucket may be lifted and lowered as illustrated in Figure 3.

Tilt assembly 15 generally consists of a pair of sprockets 60, 60 rotatably mounted on shaft 22, a pair of sprockets 61, 61 rigidly mounted on trunnions 53, 53, a drive chains 62, 62 trained about sprockets 60 and 61 and a fluid actuated cylinder assemblies 63, 63 operatively interconnecting beam members 21, 21 and rotatable sprockets 60, 60. Each of cylinder assemblies 63, 63 includes a cylinder member 63a pivotally connected at its base end to a bracket 64 connected to a beam member 21 and a rod member 65 connected to an arm member 66 rigidly secured to a sprocket 60 substantially radially relative to the axis of shaft 22. It will be appreciated that when the bucket is in an elevated position as shown in Figure 3, it may be tilted by supplying fluid under pressure to the base and rod ends of cylinder members 63a, 63a, as illustrated in Figure 4. Slack in each of chains 62 may be taken up by a chain tension adjusting device mounted on lift arms 50, 50 and operatively engageable with flights of chain 62, 62.

Bucket 51 is provided with a pair of side walls, front and rear walls and a bottom wall providing an open upper end. When the bucket is in its lower position as shown in Figure 1, the

front end of the opening in the bucket is disposed below and adjacent the upper end of the conveyor belt assembly. As best shown in Figure 5, the upper edge 51a of bucket front wall 51b is disposed below and rearwardly of shaft 23 of the conveyor belt assembly, and is provided with a transversely disposed rod 51c on which there is mounted a number of tine units 51d spaced along rod 51c. The leg portions of tine units 51d project substantially tangentially relative to rod 51a and project into the envelope defined by the outer ends of tine units 34 of the conveyor belt as they advance along their paths, substantially perpendicular to belt flight 32c as shown in Figure 1.

Leg portions 40 and 41 of each tine unit 34 of the conveyor belt lie in the same substantially vertical planes as leg portions 40 and 41 of other tine units of the conveyor belt, offset transversely relative to the leg portions of tine units 51d so that as tine leg portions 40 and 41 of the conveyor belt sweep about the axis of shaft 22 and traverse along belt flight 32c, they will pass between the leg portions of tine units 51d as shown in Figure 5.

In the use and operation of the machine as described, when the drawbar of the machine is attached to a tractor or other prime mover for use in cleaning a sandy beach, the crank of leveling mechanism 18 is operated to vary the angle between the drawbar and the support frame of the machine and correspondingly fix the positions of the ends of the leg portions of the tine units mounted on the conveyor belt along belt flight 32a relative to the ground. The ends of such leg portions thus may be positioned either above, at or just below ground level. With the frame height thus adjusted, the hydraulic motor for the conveyor belt assembly is operated and the tractor is moved ahead along the path of the tract to be cleaned. As the machine thus advances, the tine units along belt flight 32a will engage the sandy ground and debris deposited thereof and cause such debris and some of the sand with the debris to be picked up and conveyed upwardly

and rearwardly along belt flight 32b of the conveyor assembly. As the debris and sand advances along such flight, the sand particles will be caused to fall through the openings in the conveyor belt and be deposited on the ground. The debris either engaged or impaled by the leg portions of the tine units will be carried to the upper end of flight 32 and then caused to traverse about a 180° arc and through lower belt flight 32c. As the belt travels about the upper end of the conveyor assembly, a certain portion of the debris carried by the belt will gravity fall into the bucket. As the leg portions of tine units 34 advance through belt flight 32c, debris clinging to the belt and perhaps impaled by the leg portions of the tine units will be caused to be dislodged as leg portions 40 and 41 of units 34 pass between the leg portions of tine units 51 and such dislodged portions of the debris also will be caused to gravity flow into the bucket thus wiping leg portions 40 and 41 free as they progress downwardly, free to engage and convey additional debris as they traverse belt flight 32a.

The extension of the leg portions of tine units 51d into the envelope defined by the paths traversed by the outer ends of leg portions 40 and 41 of units 34, the perpendicular positions of the leg portions of units 51d relative to belt flight 32c, the positioning of the leg portions of tine units 51d below and rearwardly of the axis of shaft 23 and the passage of leg portions 40 and 41 of tine units 34 between the leg portions of tine units 51d, assures the gravity discharge of loose debris on the conveyor belt into the bucket and the removal of lodged debris on the conveyor belt through the combing effect of the leg portions of tine units 51d as leg portions 40 and 41 of tine units 34 pass therebetween, permitting such dislodged debris to also gravity fall into the bucket.

The machine may be towed and operated in the manner described until the bucket is filled with debris and it is desired to dispose of such load. Under such circumstances, the operation of the conveyor belt is simply discontinued, the leveling mechanism may be operated

to lift the front end of the support frame to facilitate travel and the machine may be towed to a suitable dump area. At the dump site, the debris may be discharged merely by operating lift cylinder assemblies 52, 52 to a position as shown in Figure 3 and then operating dump cylinder assemblies 63, 63 to cause the bucket to tilt and thus allow the debris to gravity fall onto the ground. When the bucket has been emptied, cylinder assemblies 63, 63 and 52, 52 may be operated to return the bucket to the position as shown in Figure 1. The machine would then be configured to return to the area for continuing the cleaning operation as described.

As previously mentioned, the wheel unit may be of a conventional, commercially available assembly. The support frame may be constructed of readily available steel stock, cut to suitable size and welded and/or bolted together. The shafts, sprockets and drive components of the belt conveyor assembly may consist of commercially available components. The conveyor belt may be of any commercially available construction although it is preferred that it be of a stainless steel material to withstand the corrosive and eroding effects of the material being handled. The tine units preferably are formed of spring steel wire in the configurations as described to allow flexure of the leg portions thereof when engaging the ground and obstacles in their path. The lift and dump cylinder assemblies also may be of commercially available assemblies.

It will be appreciated that the machine as described provides a comparatively simple design which is effective and efficient in gathering articles such as debris and the like deposited on a tract of ground, separating such articles from earth particles carried along with the articles, returning such earth particles to the ground and then cleanly removing the articles from the belt conveyor assembly and depositing them in a receptacle to be hauled and dumped at a suitable site.



From the foregoing detailed description, it will be evident that there are a number of changes, adaptations and modifications of the present invention which come within the province of those having ordinary skill in the art to which the aforementioned invention pertains. However, it is intended that all such variations not departing from the spirit of the invention be considered as within the scope thereof, limited solely by the appended claims.